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THE ESC COMPUTERIZED CIRCULATION SYSTEM MODEL II.

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DESCRIPTORS- *LIBRARY CIRCULATION, *AUTOMATION, COMPUTERS, COSTS, STATISTICS, SYSTEMS ANALYSIS, CATALOGS, INFORMATION PROCESSING, LIBRARY SERVICES, PERFORMANCE CRITERIA,

A NEW CIRCULATION SYSTEM NOW IN USE AT THE ELECTRONICS SYSTEMS CENTER (ESC) LIBRARY, PART OF INTERNATIONAL BUSINESS MACHINES CORPORATION, IS BASED UPON A PREVIOUS SYSTEM WHICH USED TABULATING CARDS, UNIT RECORD MACHINES, AND A SMALL COMPUTER. THE NEW SYSTEM IS A TRANSACTION CARD SYSTEM, IN WHICH ONE BASIC TYPE OF CARD FORMAT IS USED FOR CHARGING, DISCHARGING, AND OTHER TRANSACTIONS IN THE SYSTEM. NEW BOOK CARDS WERE PRODUCED BY DUPLICATING THE ORIGINAL SHELFLIST, WHICH WAS ALREADY IN MACHINE-READABLE FORMAT, FOR THE 11,000 TO 13,000 VOLUMES IN THE LIBRARY. AS A BOOK IS LOANED, THE REST OF THE CARD IS FILLED OUT WITH INFORMATION ABOUT THE BORROWER AND THE CARD IS USED TO PRODUCE A NEW BOOK CARD AND THE TRANSACTION CARD FOR THE LOAN. WHEN A BOOK IS RETURNED OR A CHANGE IN ITS LOAN STATUS IS NOTED, THIS IS ALSO RECORDED ON A TRANSACTION CARD. ALL OF THE TRANSACTION CARDS ARE CODED FOR THE APPROPRIATE ACTION BY THE COMPUTER, WHICH MANIPULATES THE INFORMATION TO DISCHARGE THE BOOKS, RECORD LOANS, AND WRITE OVERDUE NOTICES AT THE APPROPRIATE INTERVALS. OTHER OUTPUTS PRODUCED ARE--(1) A LIST OF BOOKS BORROWED ARRANGED BY BORROWER WITH A STATISTICAL SUMMARY OF THE WEEK'S ACTIVITY, (2) SHELFLIST OF THE LIBRARY BOOK COLLECTION TELLING WHERE EACH BOOK IS AND HOW OFTEN IT HAS CIRCULATED, AND (3) OTHER STATISTICAL REPORTS, SUCH AS LISTS OF BOOKS LOST. THE ONLY BOOK RELATED CIRCULATION ACTIVITIES NOT HANDLED BY THE SYSTEM ARE RESERVES AND INTERLIBRARY LOANS. THIS DOCUMENT IS ALSO AVAILABLE AS IBM-67-825-2201 IN SINGLE COPIES ON REQUEST FROM THE TECHNICAL REPORTS CENTER, INTERNATIONAL BUSINESS MACHINES CORPORATION, OWEGO, NEW YORK 13827. (CM)

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IBM

Federal Systems Division
Owego New York

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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IBM *Federal Systems Division, Electronics Systems Center, Owego, New York*

TABLE OF CONTENTS

		Page
ABSTRACT		1
INTRODUCTION		1
REQUIREMENTS		2
ADJUSTMENTS AND PLANNING		4
INSTALLATION		7
CHARGING AND DISCHARGING		10
NOTICES TO BORROWERS		12
LISTS PRODUCED		15
COSTS		19
REFERENCES		22
EXHIBIT 1	BOOK CARD SIGNED BY BORROWER AND KEYPUNCH FOR COMPUTER INPUT	23
EXHIBIT 2	FLOW CHART OF COMPUTER OPERATIONS	24
EXHIBIT 3	RECALL AND REMINDER NOTICES PRODUCED BY COMPUTER	25
EXHIBIT 4	BORROWERS' CHARGE RECORDS	26
EXHIBIT 5	SHELFLIST RECORD PRODUCED BY COMPUTER	27

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ABSTRACT

The requirements for a second-generation computerized circulation system in the library of the Electronics Systems Center, International Business Machines Corporation, are listed, and the planning, installation, operations, and cost of the system are described.

INTRODUCTION

The time it took to produce recall notices and make follow-up phone calls for the 100 to 150 reserve books handled weekly convinced the circulation assistant and the library administrator of the Electronics Systems Center that the ESC library needed a more mechanized circulation system.

The system ESC was using had been developed when automation of such routines as circulation was still so new each library had to pioneer its own method. It had worked usefully for several years giving us loan record cards filed by author of the book and by the name of the borrower; quarterly reminder notices to all borrowers of books in their possession; a satisfactory way of recording what books were reserved but not of recalling the reserved items; and previously unavailable statistics on usage which have been discussed

in detail elsewhere (Ref. 1). It did not provide means of keeping up with a borrower's changes in location, of pulling together charges for a borrower who was inconsistent in how he signed his name on loan slips, or of providing all the statistics the library administrator wanted. The basic elements of the system involved unit record machines, cards, and a small computer. The unit record machines prepared and sorted punched cards that were manually filed into or pulled from working files; the card files were manipulated in a limited fashion on occasion by an IBM 1401 computer. The circulation assistant had to do much repetitive work a machine could do as well, and machines were not used to their highest capacity. To put it kindly, the system had become out of date, and staff members who worked with it daily recognized that.

REQUIREMENTS

The library staff agreed that a satisfactory circulation system for the ESC library must satisfy the following demands:

- Tell what items are out of the library and where they are. The library loans books, single unbound issues of periodicals, and miscellaneous non-book items such as college catalogs. All should be covered in an ideal circulation system. Loans were for periods of one day, two weeks, the normal period best described as "until the reader was done with the book or three years passed", and permanently, a term used for library books assigned as desk reference tools outside the library. Loans and returns average

about 1000 each per month. Slightly less than 23% of the entire collection, or around 2800 books, are charged out at any one time.

- Tell who has library material charged and what items each borrower is accountable for. It should also provide information on the current address of borrowers as automatically as possible, and should pull together all items borrowed by an individual, no matter how he signs his name. Between 800 and 1000 individuals have material charged out of the library at any one time.
- Provide a way to reserve items that are not currently in the library, for later use by another reader or readers. Between 250-300 items are on reserve at any one time.
- Provide a way to recall reserved material and material that has passed the time limit of the loan.
- Notify library patrons at regular intervals of library materials for which he is accountable but whose return is not necessarily required. Such a written reminder often alerts a patron to a long-held loan he had forgotten to return.
- Provide the various statistics required for better administration. Sixteen different questions for which circulation statistics could provide answers were listed and where the statistics could be obtained in the circulation process indicated.
- Fulfill the above requirements by the most economic and efficient combination of man and machine operations applicable for our situation, and to do so without delay, so information available to the circulation assistant would always be both accurate and current.

ADJUSTMENTS AND PLANNING

Flow charts describing each of the various operations in circulation work as ESC did them were drawn up. All the rules and customs affecting library circulation in ESC were looked at, and a decision was made for each as to whether there was good reason for it being allowed to stand requiring the new system to conform to it, or whether it could be altered to adjust to the constraints of the machine. The systems analyst was consulted and the limits within which the system would be designed were more sharply drawn.

It was evident quite early that including charges for magazine and other miscellaneous items loaned would create more problems in developing an efficient computerized system than the number of loans of this material justified. It was decided the circulation system being developed would limit itself to books, which represented over 90% of all loans. Magazine circulation, which represented about 8% of total loans, would be handled by a proposed second-generation serials control system.

An adjustment was made in the custom of the normal loan by giving it a more definite time limit. Studies of the habits of our borrowers showed that about 50% of all books borrowed were returned within two months of the charge date (Ref. 1), so three months were set as the period such loans would be left in the borrower's hands before a reminder notice was sent. After one notice, we would wait three months before sending another reminder, our studies having shown that over 80% of all loans were returned within six months.

A more serious adjustment had to be made with our shelflist record and our book cards. The shelflist, in which one IBM punched card represented one book in our collection, used all 80 columns for the data describing the book. The bookcard was a replica, on an IBM card of another color (yellow), of the shelflist card. Unlike the bookcards used in another computerized circulation system in the corporation (Ref. 2), the ESC card had been set up with fixed fields for descriptive data; they were -

Identification number (columns 1-19) divided into subfields:

cols. 1-13 - Library of Congress classification number (col. 1-10) and our author number (col. 11-13).

Of these, columns 1, 2 and 11 are always alphabetic when used, column 7 always contains a period, columns 8-10 are blank (in evidence of an early error of judgement; we thought our collection might use expanded LC classification numbers but it does not). The remaining columns are numeric

cols. 14-15 - Last two digits of year of publication

The ESC library deals with subjects developed in the last twenty years so no confusion is caused by omitting the century digits.

cols. 16-17 - Volume number, if any.

cols. 18-19 - Copy number, if any.

Author entry (columns 20-39)

The last name of the first author with his initials. When the main entry is an organization, the name is abbreviated to fit into 19

spaces. No standard abbreviations were attempted when we originally set up the punched card shelflist and we still abbreviate inconsistently, though we now agree with Gibson and Randall's recommendation of standard abbreviations if a computerized circulation system is planned (Ref. 2). It makes for consistency in filing and finding.

Title, followed by the edition number if any (columns 40-80)

No abbreviations had been found necessary with so much space. The title was usually quite identifiable even when it was abbreviated at column 64 which our first circulation system did in producing the borrower's record card.

To achieve efficiency in computer input in the new system, the bookcard format had to be altered by cutting off the title at column 61 and reserving the remaining 19 columns for recording borrower and loan information when the book was loaned. Because we felt (and this has been confirmed by experience) there would be only a minor amount of confusion with titles so shortened, new bookcards, duplicating columns 1-61 from the original 1-80 shelflist card, were gang-punched for our entire collection and replaced the old cards in book pockets as the new circulation system was installed. (This was the most time-consuming part of the system change-over for the library staff since bookcards for between 11,000 and 13,000 volumes had to be exchanged.)

One very minor problem did arise in changing the bookcard format. In certain serials, the identification number (columns 1-19), author, and title

were identical for more than one volume, with the edition data at the end of the title the only unique item. With the abbreviation of the title, the edition data was lost, causing recognition problems for the computer. This was solved by moving the edition data for these problem cards into the author field. Only about 50 cards had to be handled in this way.

The system analyst and the library administrator looked into the possibility of making the new circulation system an on-line, real-time operation but regretfully concluded that the number of loans and returns to be handled daily did not justify the equipment cost. We could get as much currency of records as we needed by batching our work in daily, weekly, and less frequent schedules. Nine months' experience with the new system confirms batching provides records sufficiently up to date, although the convenience to us of certain records, originally scheduled to be produced every six months, has resulted in their being produced monthly.

INSTALLATION

When library and systems personnel had made the adjustments in thinking and operations necessary for the requirements of the computer, development of the routines and programs of the new system quickly followed. Initial installation and operation began in February 1967 and, although delayed a few weeks by an under-estimate of the number of new cards required, the system was fully installed by mid-March with the old records phased out. Minor modifications to the system have, of course, continued as library staff thinks of something else they'd like the machines to do or the systems

analyst sees a better way to handle an operation. While the modifications have produced a more refined and sophisticated system, no major feature of the original design has been changed. The tinkering is nothing more than evidence of the reluctance with which craftsmen part with a product of which they are proud.

A first step in installing the new circulation system, and a good place to start describing its operation, was putting the shelflist on magnetic tape. Although the old keypunched shelflist has not been abandoned, the official shelflist is now the abbreviated data on magnetic tape. Additions to, or deletions from, the shelflist are punched on IBM cards which are sent to update the tape whenever the number of changes justifies doing so. This updating is done at the same time a regular circulation report is being prepared.

The bookcard is used to produce loan and return records. Earlier in this paper the truncation of data shown on the original book card was described; it was not made clear that the bookcards were also re-designed. In order to find an effective way to keep circulation records abreast of a borrower's changes of location and to pull together records for borrowers who were inconsistent in the way they signed their names to loan records, it was necessary to begin using the borrower's payroll serial number as part of the loan record. The new bookcard format added spaces for the employee number and the borrower's office phone number, and continued to request the borrower's last name and initials, his department number and the date of borrowing. (Exhibit 1) All this data is on one line which the borrower is asked to fill in

at the time of loan. If the borrower does no more than sign his name and give his department number, the staff fills in both the payroll number from a limited-distribution personnel list that gives employee payroll numbers, and the date of loan. The office telephone number is requested only for the convenience of the circulation assistant, should she have to phone for the return of the book. Should the borrower not be on the plant payroll (the library serves any one who works regularly within the facility and contractors' and government liaison office personnel use the library), a special symbol is used by the library staff to tell the computer not to reject the card as an incomplete or improper record.

The library staff also fills in two additional blanks on the card, indicating the type of loan it is, and what sort of transaction. The ESC library has four types of loans, with differing recall features:

1. Regular (Reminders sent every 90 days)
2. Reserved books (Recalls sent every 2 weeks)
3. Reference books (Loaned for 1 day only)
4. Long-term or "permanent" assignments (No recall)

The transaction code is, for the library staff, usually "1", which tells the computer to discharge the loan. Transaction code "2" is used to tell the computer the book is charged and to add the record to the borrower named. This code is assigned by the keypunch operator when she punches up the required circulation records for the day. Other codes may be used; they are:

1. Discharge - Removes book from man tape. Codes books as in library on book master tape. (Punched on yellow card)

2. Charge - Adds book to man tape charged to man. Codes book as out of library on book master (Usually assigned by keypunch operator to special salmon charge card)
3. Delete - Remove record for book from man tape (Yellow card)
4. Add - Adds record to man tape (Yellow card)
5. Change Number of Books Borrowed - Replaces no. of books borrowed with data in columns 78-80 of card. (Yellow card)
6. Lost - Removes book from man tape. Adds 1 to total books lost by man. Codes book lost on book master tape. (Yellow card)
7. New book charged out regularly, but now put on reserve. (Produces immediate recall notice) (Yellow card)
8. Renew (Yellow)

CHARGING AND DISCHARGING

After the borrower has signed the bookcard, the circulation assistant verifies his information is complete and legible, and adds the loan and transaction codes. Once a day the bookcards are collected and taken to the keypunch operator. For each signed bookcard, she produces another bookcard punched columns 1-61 to replace the original. The original card is now completed by punching columns 62-80, in four fields: columns 62-3 for loan and transaction codes; column 64 for the symbol for a borrower not listed on plant payroll records; columns 65-70 for employee payroll serial number, and columns 71-80 for borrower's last name. This card is duplicated, except for column 63, on a salmon-colored card; it is in column 63 of the salmon

charge card that transaction code "2" is punched. All three cards - the yellow card signed by the borrower and now completely punched, the unsigned new yellow bookcard, and the salmon-colored almost-duplicate of the completed bookcard are returned to the library. The circulation assistant files the two yellow cards by the book's author (columns 20-39) in the file of books charged out; the salmon card is placed in the unarranged deck of transaction record cards to be taken to the computer. That completes the loan formalities for the library staff for most loan records. The only other formality observed has to do with reserved book loans. The list of names of people who have reserved a title are filed with the author cards for a reserved book, and a colored metal clip is put on the signed author card to further alert the staff in discharging the book or in consulting the file.

Discharging a book involves pulling the two bookcards from the author file. The blank card goes into the pocket of the book and it is ready for shelving. The signed card is dropped into the deck of transaction cards to be taken to the computer.

If a change in status of the charge occurs, the transaction code must be changed. This is done by sending the original bookcard back to the keypunch operator with a note to change the code. She punches another yellow card with the new transaction code, and returns both cards to the library. The original bookcard returns to its place in the author file, and the new yellow card goes into the transaction deck to instruct the computer.

Once a week, all transaction cards are taken to the computer, accompanied by two packs of blank notice cards - yellow recall and blue reminder. The transaction cards are used to add to, correct or delete material from the borrower (or man) tape kept in the computer library. The transactions are sorted to employee serial number and are matched with the existing tape listing borrowers and their charges and the payroll tape (Exhibit 2), and a record of books borrowed arranged by name of borrower is produced. Recall and reminder notices, as necessary, are produced at the same time. These are triggered by the date of loan, which is registered on the transaction tape when the loan is entered. The date is reported in five digits -- the first two being the last two digits of the year, the next three, the number of the day in the year; thus, the date, July 4, 1967, appears as 67185.

NOTICES TO BORROWERS

Two weeks after a type 2 loan enters the man tape, a recall notice is automatically produced by the computer if the loan has not been returned. Similarly, loan code 3 triggers an immediate recall notice without any waiting time. Loan code 1 produces a reminder notice 90 days after date of loan. Please notice that "recall" and "reminder" notices are mentioned. (Exhibit 3). Recall notices are printed on yellow card stock and the text specifically requests the return of the material for the use of other borrowers. A new recall notice is issued each succeeding week until three have been produced by the computer; after the third, the computer signals to the circulation assistant that human effort is needed to get the book back. This signal is continued

until the book is returned or cleared from the tape as lost. Reminder notice, formatted in the same way as the recall notice for displaying information about the book and giving mailing instructions, is on blue card stock. Its text reminds the borrower he has the book and suggests its return if he is through with it; the borrower is also told that, by signing and returning the card, his loan will be renewed. If the borrower ignores the first such reminder, the computer does not send a second reminder card the next week, but waits another 90 days before sending the second. Once more, the computer waits — this time only two weeks, and then switches to recall notices, and follows that sequence.

Normal loans, as noted, may be renewed. A change in transaction code, using transaction code 8, accomplishes this. Reserved books and short-term loans may not be renewed, though the borrower may request another turn on the reserve list. Reserve books, when sent to the borrower, carry an eye-catching notice clipped to the front cover telling him it is a limited loan book which must be returned for the use of others. When a book on normal loan is reserved while it is in use, the circulation assistant has several methods open to her depending on the circumstances: she may call the borrower and ask for the immediate return of the loan; she may send out a form notice filled in by herself telling him the book is reserved and requesting its return at a given date, at the same time putting into the computer run a change of loan code to produce a 2 week notice in the regular way; or she may put in a change of transaction code card instructing the computer to produce its recall notice at once.

We have found that, with these regularly produced and mailed notices (the notices come back to the library for visual checking and placing in the mail), the turnover of reserved books are quicker; normal loans come back to the library more quickly than before; and fewer books are reported 'lost' by customers. Since the new circulation system went in there has been a marked reduction in the amount of shelf-space available in the stacks and there has also been a slight increase in the number of loans. Using these elements as basis, we believe the increased availability of material to the reader through prompter returns has effectively increased our collection by 6%.

The fourth type of loan is the long-term loan, or the permanent assignment of library materials for desk reference in a particular department. Under the old system, these books were charged to the department itself and notices listing what each department was supposed to have, were prepared and sent out in June and December. One of the adjustments required by the new system was that these books be charged to individuals, not to a department, and the system was set up to send out reminder notices in March, June, September and December. These notices are in a third form, a sheet printout of the books charged, headed by an explanatory paragraph explaining the list and requesting the return of books no longer used. Even in the short time this system has been in operation, we notice a greater sense of responsibility for safeguarding these desk tools and for reporting changes in their location. Losses (which are really no actual losses, only losing track of books for months or years) have dropped off.

LISTS PRODUCED

The explanation of what the computer produced each week was interrupted by a digression on the kind of notices produced and their effect. As we said, the computer produces a list of books borrowed, arranged by name of the borrower. (Exhibit 4) This listing is extremely useful for a number of purposes, other than the one which demanded its production -- that of having an up-to-date listing of all library material charged to an individual in a situation where transfer of employees between facilities may occur on short notice. One of the services this list and the next to be described performs that the library staff did not anticipate in our planning, but which the systems analyst recognized was required, is to identify errors in assigning classification and book numbers, charging, or keypunching. The computer rejects charges for books which do not have unique identification; when the usual identification group (columns 1-19) are identical on cards, the computer reads columns 20-39 (author) to look for a difference. If that, too, is identical, the record is rejected and the offending card is printed out with a flag for attention on the listing so the library staff may investigate and correct the error. Similarly, if payroll number cited for the borrower is not found on the payroll master tape, the card is rejected. All errors that effect the record are rejected, flagged, and the reason for rejection noted on the listing. Having errors brought to staff attention while memories are still fresh prevents greater trouble later.

The listing of loans by borrowers contains information about the borrower and about each loan to him. The borrower's location and name are always correct and consistent; the use of the payroll tape assures that. How active a borrower he is, is shown by a report of the total number of books he has borrowed during the year. The books currently on loan are identified by notations as to their status; any one of 15 different possibilities may be recorded for an item, though "Charge" and "Return" are the most frequent.

A final statistical summary at the end of the list reports how many books are on loan this week, how many new charges were made, and how many returns came in. These figures are broken down into sub-totals by management and non-management personnel for use in the library administration's studies of library use.

Upon request, the computer will also print a report showing the complete shelflist of the library book collection, with an indication of where each item is, how many times it has circulated, who the last borrower was if the book is now in the library. (Exhibit 5) It is this particular report that has proved so useful that it is being produced monthly rather than semiannually as originally intended. The circulation assistant and the cataloger both say it saves steps having a copy at their desks for consultation. The circulation assistant praises the "last borrower" feature as being helpful in many situations. The library administrator finds the tabulation of use of each volume very helpful even though the data reflects for now less than a year's use — already it shows the quality of our collection by the pattern of use, and

indicates subject areas where weeding or more selective buying could profitably be imposed. The innate conservatism of the cataloger insists that we continue to maintain the original keypunched card shelflist, but the library administrator suspects its use will decline so that, within the coming year, we can consider abandoning it and depending instead entirely on the book shelflist.

Other statistical reports are also produced by the computer upon request. One of these is always asked for with the shelflist — totals of all books currently owned by the library, how many are on loan and in what type of loan. We can get a report listing all borrowers by their department and division, as an aid to determining where library service is used. Lists of books lost are producible by class number or by name of the borrower who lost them. (The mere rumor of the existence of that particular listing seems to have encouraged more borrower responsibility about keeping track of library books!) All who have borrowed books during the year may be listed, so that library administration can determine exactly who our current users are, if we wish. These reports provide far more precise information about circulation than the administrator has ever had readily available and permits detailed investigation of how the library serves its clientele.

The new circulation system fills all the requirements originally specified, in most cases with the machine doing routine operations rather than man. In only two aspects of book circulation is there much dependence on the human — the recording of reserves and the interlibrary loan — and in both cases the decision to depend on human operations was made deliberately.

While Gibson and Randall (Ref. 2) report a means of recording on the computer reserves for a given book and for listing the reserves along with the loan records, ESC library staff felt it would be more economic to by-pass this step. The majority of our reserve requests are made on the IBM-card-size request form that accompanies our accessions announcement sheet. This request form, when filled out, contains all the data needed for the charge record, so filing the request form with the outstanding charge for the book wanted involves, we think, less time than entering requests into the computer would. In both systems, the circulation assistant has to clear the old charge and enter the new. Our system permits the circulation assistant to exercise some judgment based on knowledge of borrowers' needs and habits in the sequence in which reserved items are sent to requesters.

As for interlibrary loans, the loans we make to other libraries are handled in our circulation system just as if they were loaned to people working in the plant who are not on the plant payroll. Since all such loans are listed on the borrowers' report behind the regular employees, it is easy for the circulation assistant to watch these records and to send the recall notice only after the four-week interlibrary loan period is up. Books we borrow from other libraries are kept out of the circulation system entirely because they are the responsibility of the interlibrary loan librarian as official borrower.

COSTS

The Library Technology Project, reviewing automated circulation systems (Ref. 3), reported that they are more expensive than the conventional types. This is true if one does not consider the time saved by them; even so, it need not be a decisive factor. Machine costs are not always as great as one might suppose, as will be shown.

Our new system saves time in at least two positions in the library. For the circulation assistant in these ways: filing of daily loan and return records are cut in half -- since cards are filed and pulled from one file, rather than two as in our old system; the new recall and reminder notices are fully addressed by the computer and may be put in plant mail without a covering envelope; recall and reminder notices are produced by machine, rather than by hand, and they are produced automatically and regularly; difficulties of identification or location of borrower have been minimized by the use of the payroll serial number, notices go to the right person the first time; reserve requests are filled more easily and the processing time for reserves is quicker; errors or improper actions are identified early when their correction is uncomplicated so snags are fewer. The library administrator's time is saved by having statistics presented to her that formerly she had to develop from raw data. Four months after the new circulation system was installed, we found that 28 man-hours a month were being spent in various operations related to circulation where 101 had been spent under the old system. (It is unfortunate that we did not work out a similar comparison of

time saved between our original completely manual circulation operation and the first mechanized system; it would be very interesting to compare times for the three ways of operation.)

Machine hours, four months after the installation of our system, were: 4 hours per month keypunch time (no change from the amount used in our first mechanized system); 1.17 hours on the IBM 1460 computer as against .5 hours for the old system; and .62 hours on the IBM 7010 computer. The machine costs of the system per month total only 4% of its savings in man-hours; we feel this is a bargain.

The costs of installing the system are one time costs; what this library did may not necessarily be what another library would have to do. The activities involved were: planning by the library administrator and the systems analyst; programming and de-bugging; designing and procuring new cards and notice forms; keypunching cards; exchanging bookcards in the collection, and re-charging all outstanding charges; and taping the shelflist. We do not have full records of the amount of time spent by the librarian and the systems analyst, or in writing and de-bugging the programs. The expenses of the other parts of the change-over totaled 160 man-hours and the cost of approximately 20,000 IBM cards and forms and the magnetic tape required to store the shelflist. We expect to recover this expense within the first two years of the new system in savings from reducing the loss of books which would have gone missing under the old system of notices and records, and in reducing the time spent clearing up snags.

The increased control we have over circulation routines, the improved records and the more complete statistics, all contribute to our enthusiasm for our system. After eleven months of operation, we have yet to find any serious weakness in it, other than the fact that all systems are subject to human mistakes whether they are manual or machine systems. Operator error, by the library staff and by the machine operator, does occur; fortunately, error in a machine system is highly visible and may be redeemed promptly.

The system fits the ESC library because it was tailored for our needs. It is also universal enough to be potentially useful to other special libraries. Larger collections and heavier circulation activity would increase the machine time and costs to some minor degree but should not otherwise affect the system's efficiency.

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Exhibit 1

BOOK CARD SIGNED BY BORROWER AND KEYPUNCH FOR COMPUTER INPUT

QA0417. G7 66 GRIFFEL.H HDBK OF FORMLAS FOR S11 08184 0SCOTT GW

CAL. NO.	YEAR	VOL	COPY	AUTHOR	TITLE	TC	SC	SERIAL NO.	LAST NAME

	EMPL SERIAL NO.	LAST NAME	INITIALS	DEPT. NO.	EXTENSION	DATE BORROWED
JC	08184 0	Scott	G W	603	2397	MAY 11, 57

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BOOK CHARGE CUT

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1 2 3 4 5 6 7 8 9 10 11 12 13	14 15	16 17	18 19	20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39	40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	62 63	64	65 66 67 68 69 70	71 72 73 74 75 76 77 78 79 80

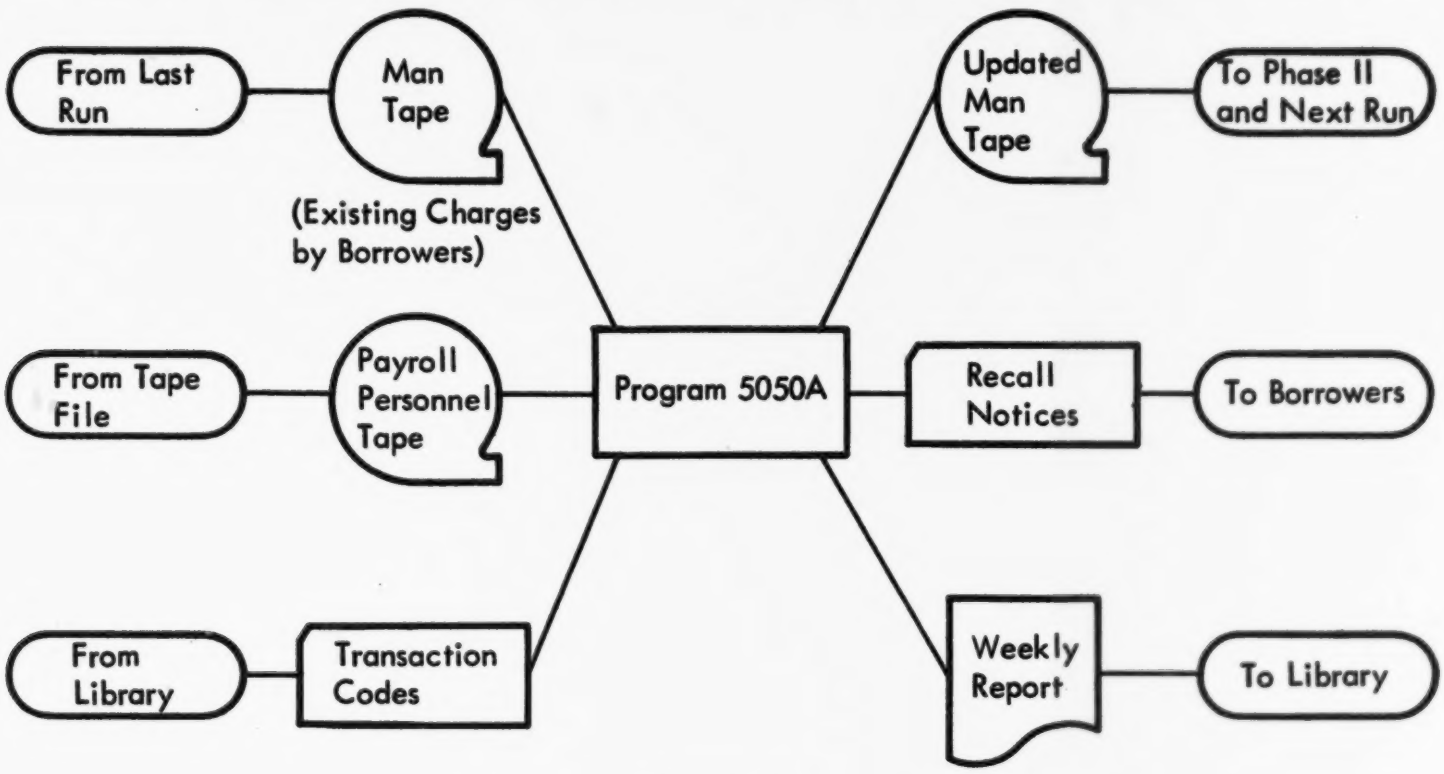
IBM 847240

Exhibit 2

FLOW CHART OF COMPUTER OPERATIONS

Phase I

Employee Oriented – Produces Borrowers Record File and Notices Weekly



Phase II

Book Oriented – Produces Catalog Shelflist, Monthly. Other Book-Oriented Reports are Produced Using Modification of Program.

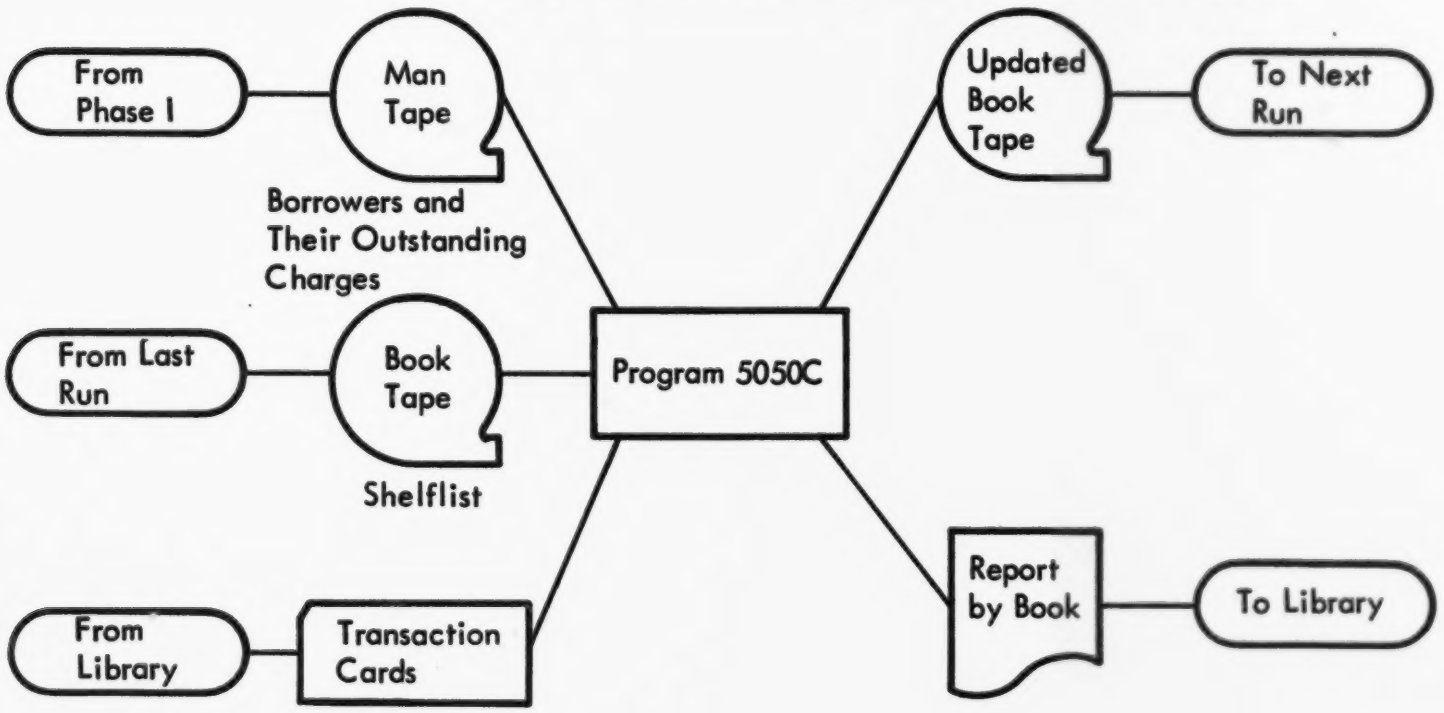


Exhibit 3

RECALL AND REMINDER NOTICES PRODUCED BY COMPUTER

DEPT. 521 **NAME** F G ZAPPERT **RETURN NOTICE** 1
TITLE POTENTIAL BARRIERS IN **AUTHOR** GOSSICK, BR

THE ABOVE BOOK HAS BEEN CHARGED TO YOU FOR 3 MONTHS.
PLEASE RETURN IT TO

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IBM CORPORATION
OWEGO, N. Y. 13827

SO THAT OTHERS MAY HAVE ACCESS TO IT. IF YOU ARE STILL USING IT. IT MAY BE RENEWED BY CALLING EXT. 2720 OR BY RETURNING THIS CARD SIGNED AND DATED. YOUR SIGNATURE WILL SERVE AS REQUEST FOR RENEWAL.

IBM

DEPT. 293 **NAME** M S SEMANEK **RECALL NOTICE** 2ND
TITLE PERFORMANCE RATING **AUTHOR** BARRETT, RS

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Exhibit 4

BORROWERS' CHARGE RECORDS

REPORT 91476 CURRENT CIRCULATION AND ACTIVITY BY EMPLOYEE NUMBER OCTOBER 31, 1967

EMPLOYEE NUMBER	NAME	DIV	DPT	CODE	DATEND BORR	ACTIVITY BY EMPLOYEE NUMBER TRANS		CALL NO	YR	VOL	COPY	AUTHOR	TITLE	ERROR
* 108746	M BLOMFIELD-BROW	71	287	5807	67164	REMD	1	TT0273.	K6604			KOSLOFF,A	SCREEN PROCESS PRINTIN	
* 108746	M BLOMFIELD-BROW	71	287	5807	67164	REMD	1	TT0360.	Z2556			ZAHN,B	SCREEN PROCESS METHODS	
	TOTAL BOOKS BORROWED 2			DEPARTMENTAL										
108748	C R BLIVIN	51	544	5806	67297		1	BF0121.	S2665			SANFORD,FH	PSYCHOLOGY/2D ED	
108748	C R BLIVIN	51	544	5806	67255		1	BF0321.	N6 57		01	NICHOLS,RG	ARE YOU LISTENING	
108748	C R BLIVIN	51	544	5806	67304	CHG	1	BJ1498.	B7561			BRIGHTBILL,CK	MAN AND LEISURE	
108748	C R BLIVIN	51	544	5806	67304	CHG	2	QA0076.	K5267			KLERER,M	DIGITAL COMPUTER USERS	
108748	C R BLIVIN	51	544	5806	67262	RET	1	TA0151.	S5766		02	SOUDERS,M	ENGINEERS COMPANION	
108748	C R BLIVIN	51	544	5806	67262	RET	1	TA0159.	L3 66		02	LA LONDE,WS	PROF ENGRS EXAM QUES A	
108748	C R BLIVIN	51	544	5806	67262		1	TA0161.	K7 62			KRAUS,AD	STUDYING TO PASS THE P	
108748	C R BLIVIN	51	544	5806	67143		1	TA0345.	H3 66			HABERMAN,CM	USE OF DIGITAL COMPUTE	
108748	C R BLIVIN	51	544	5806	67234		1	TK7870.	C6255			CORNELL AERONAUT.LAB	HEAT TRANSFER IN MINIA	
108748	C R BLIVIN	51	544	5806	67234	RET	1	TL0790.	P8664		02	PURSER,PE	MANNED SPACECRAFT	
108748	C R BLIVIN	51	544	5806	67234	RET	1	TP0369.	C5263			CHECHETKIN,AV	HIGH TEMPERATURE HEAT	
108748	C R BLIVIN	51	544	5806	67234		1	TP0363.	G4 62			GEIRINGER,PL	HANDBOOK OF HEAT TRANS	
	TOTAL BOOKS BORROWED 26			DEPARTMENTAL										
* 108749	D P BLOWNEY	56	576	5802	67276	****	2	JF0515.	R6651		03	ROBERT,HM	RULES OF ORDER	
108749	D P BLOWNEY	56	576	5802	67213	RET	1	QA0275.	B5565			BLACKMAN,RB	LINEAR DATA SMOOTHING	
	TOTAL BOOKS BORROWED 38			DEPARTMENTAL										
908843	B A BLUNDELL	W6	W51	5559	67276	RNEW	1	TK7872.	S4 60			SCROGGIE,MG	FUNDAMENTALS OF SEMICO	
	TOTAL BOOKS BORROWED 1			DEPARTMENTAL										
108847	J C BOBROWSKI	69	394	5807	67290	RET	2	VK0388.	U6263		02	US BUR NAVPERS	INTRO TO SONAR/2D ED	
	TOTAL BOOKS BORROWED 1			DEPARTMENTAL										
708851	W O BODINE	22	924	4799	67262		4	QA0055.	M6542		08	MOLINA,EC	POISSON/S EXPONENTIAL	
708851	W O BODINE	22	924	4799	67262		4	T 0011.	T8 64		03	TURNER,RP	TECHNICAL WRITERS & ED	
708851	W O BODINE	22	924	4799	67262		4	Z 0259.	U5859		05	U.S.GOVT.PRINT.OFF	STYLE MANUAL.REV.ED	
	TOTAL BOOKS BORROWED 0			DEPARTMENTAL		3								
308853	K F BOLL	E4	531	5808	67262		1	QA0037.	S2965			SCHELKUNOFF,SA	APPLIED MATH FOR ENGRS	
308853	K F BOLL	E4	531	5808	67262		1	QC0611.	D8657		08	DUNLAP,WC	INTRODUCTION TO SEMICO	
308853	K F BOLL	E4	531	5808	67073		1	TK6552.	F4 56		02	REFERENCE	REFERENCE DATA FOR RAD	
308853	K F BOLL	E4	531	5808	67269		1	TK7835.	M5656		05	MILLMAN,J	PULSE AND DIGITAL CIRC	
308853	K F BOLL	E4	531	5808	67290		1	TK7870.	C6561			COTE,AJ	LINEAR VACUUM-TUBE & T	
308853	K F BOLL	E4	531	5808	67255		1	TK7879.	S4866			SHIERS,G	DESIGN AND CONSTR OF E	
308853	K F BOLL	E4	531	5808	67164		1	TK7872.	S6466		01	SHEA,RF	AMPLIFIER HANDBOOK	
	TOTAL BOOKS BORROWED 23			DEPARTMENTAL										
009002	W A BOHAN	50	502	1801	67073	LOST	1	QA0075.	R5 55		05	RICHARDS,RK	ARITHMETIC OPNS IN DIG	
009002	W A BOHAN	50	502	1801	67269		4	TA0169.	S8 63		02	STAFFORD,AR	SCIENCE-ENGINEERING SE	
	TOTAL BOOKS BORROWED 5			DEPARTMENTAL		1								

Exhibit 5

SHELFLIST RECORD PRODUCED BY COMPUTER

REPORT 91478 CURRENT CIRCULATION AND ACTIVITY BY BOOK NO. DATE 67 322

CALL NO	YR	VOL	COPY	AUTHOR	TITLE	DATE BOR	TIMES BORROWED MANAG	TIMES BORROWED NNBNAG	TIMES BORROWED TOT	TYPE	NAN NO	OPT	CIV	NAME
VK0571.	07	60	05	DRAPER,CS	INERTIAL GUIDANCE	67255	1		1	DEP	350000	L70	43 F L	KALLIN
VK0571.	07	60	06	DRAPER,CS	INERTIAL GUIDANCE			1	1	IN	094243	L77	43 C P	WALES
VK0571.	E4	62		FERNANDEZ,M	INERTIAL GUIDANCE ENGI	67297		3	3	CUT	118211	K40	89 C	COLLIS
VK0571.	M3	61		MARKEY,WR	MECHANICS OF INERTIAL	67C59	1		1	LST	348120	502	50 F F	JENNY
VK0572.	03	64		O/CONNELL,CF	INERTIAL NAVIGATION	67297		2	2	CUT	524030	372	69 E W	CERENTHAL
VK0571.	03	64	02	O/CONNELL,CF	INERTIAL NAVIGATION	67304		4	4	CUT	149439	576	56 M	JUCKOVICS
VK0571.	P5	62		PITMAN,GR	INERTIAL GUIDANCE	67297		3	3	CUT	692050	533	56 R J	URQUHART
VK0571.	P5	62	02	PITMAN,GR	INERTIAL GUIDANCE	67312	1	2	3	CUT	108740	K40	89 M H	BLCEM
VK0571.	P5	62	04	PITMAN,GR	INERTIAL GUIDANCE	67255	1		1	DEP	075390	M84	89 J V	PRIKAZSKY
VK0583.	35664	01		SLATER,JM	INERTIAL GUIDANCE SENS					IN				
VK0583.	35664	02		SLATER,JM	INERTIAL GUIDANCE SENS	67297		2	2	CUT	118211	K40	89 C	COLLIS
VK0584.	C6	63		CCCHEN,I	ANALYSIS & DESIGN OF T	67297		2	2	CUT	118211	K40	89 C	COLLIS
VK0584.	P5	48	01	PIERCE,JA	.ORAN					IN				
VK0584.	P5	48	02	PIERCE,JA	LORAN	67262		1	1	CUT	077124	507	56 J B	REYNOLDS
VK0584.	S3	61		SAVET,PM,ED.	GYROSCOPES	67213				IN	482517	507	56 R L	SHARP
VK0584.	T7	64		TRAINING SYSTEMS	GYRO FUNDAMENTALS	67255		1	1	CUT	524030	372	69 E W	CERENTHAL
VK0587.	M2460			MCCLURE,CL	THEORY OF INERTIAL GUI	67C06		1	1	IN	553764	536	45 M A	KRUSE
VK0587.	M2460	06		MCCLURE,CL	THEORY OF INERTIAL GUI	67256	1		1	DEP	637042	590	43 L L	GREBE
VK0587.	M2460	07		MCCLURE,CL	THEORY OF INERTIAL GUI					IN				
VK0587.	M2460	10		MCCLURE,CL	THEORY OF INERTIAL GUI	67262	1		1	DEP	840613	390	68 W J	HARTNETT
VK1C12.	I5764			INT BUCY TECH SYMP	TRANS OF THE 1964 BUOY					IN				
VM0162.	S9	60		SYMPOSIUM/1958	STRUCTURAL MECHANICS					IN				
VM0356.	B6361	03		US SUBMARINE SCH#	SUBMARINE	67276		1	1	CUT	228822	L33	55 C W	ERLE
VM0480.	A5259			US BUR.NAVAL PERSON.	ELECTRONICS TECHNICIAN					IN				
VM0480.	A5260			US BUR OF NAVAL PL	SHIPBOARD ELECTRONIC E	67143	1		1	IN	294343	559	56 R K	WALTER
VM0480.	A526202			US NAT BUR STANDARDS	HDBK OF RREFERRED CIRC					IN				
VM0480.	F3863			FEDERAL ELEC CORP	BUREAU OF SHIPS RELIAB	67262	1		1	DEP	099372	351	69 M A	YOUNG
VM0480.	F4	62	01	FEDERAL ELEC CORP	MAINTAINABILITY DESIGN	67255	1		1	DEP	000950	L70	43 W S	ALEXANDER
VM0480.	F4	62	02	FEDERAL ELEC CORP	MAINTAINABILITY DESIGN	67234		1	1	CUT	032022	576	56 T M	FOKINE
VM0480.	F4	65		FEDERAL ELEC CORP	MAINTAINABILITY DESIGN	67171		2	2	CUT	066992	290	68 R P	MOORE
VM0480.	U5362	01		US BUR NAV WEAPONS	WORKMANSHIP AND DESIGN					IN				
VM0480.	U5362	02		US BUR NAV WEAPONS	WORKMANSHIP AND DESIGN	67255	1		1	DEP	000950	L70	43 W S	ALEXANDER
VM0774.	C7	60		CROUCH,HF	NUCLEAR SHIP PROPULSIO					IN				
VM0989.	P5361			PICCARD,J	SEVEN MILES DOWN	67C94		1	1	IN	600327	592	44 C L	AGOSTINI
Z 663.	U5466			US LIB OF CONGRESS	POP NAMES OF US GOVT R					IN				
Z 0049.	D8864			DUNFORD,NJ	HANDBOOK FOR TECHNICAL			1	1	IN	147352	371	69 C W	ISHAM